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The British West Indies colored race starting with a sex ratio of 103.64 ± 2.75 in the offspring of *primipara* shows in subsequent births a ratio of 112.02 ± 2.76 while in the European pure the ratio of first births is 115.51 ± 1.5 and subsequent births show a *decrease* of males; the ratio being 97.33 ± 1.18.

So also the differences between "pure" and "hybrid" races are in the opposite direction in the colored and white races. The "pure" European have a sex ratio of 104.54 ± 0.97 and the European hybrids a ratio of 122.86 ± 2.14—showing an *excess of males*. On the other hand the British West Indies colored which as we have seen is, compared with the United States colored, relatively the purer, has a ratio of 107.92 ± 2.65, while the United States colored has a ratio of 96.12 ± 1.76 an *excess of females*.

It seems, therefore, that the following conclusions as regards material in the records of the Sloane Maternity Hospital of New York City, may be drawn as a guide for further investigations.

(1) Hybrid white matings give a significant *excess of males* over "pure" white matings.

(2) Hybrid colored matings give a significant *excess of females* over relatively "pure" colored matings.

(3) The difference between the sex ratio of the United States born whites and the United States born colored is nine times its probable error.

(4) In "pure" European matings the offspring of *primipara* have a sex ratio of 115.51 ± 1.5, while the offspring from subsequent births have a ratio of 97.33 ± 1.18. The difference is 9.7 times its probable error.

(5) In the hybrid matings studied no such difference between the sex ratio of offspring of *primipara* and of subsequent births exists.

(6) The sex ratios of the United States white births recorded is not significantly different from that of *hybrid* European matings.

[1] *Proc. Soc. Exp. Biol. Med.*, 1919.

[2] *Biol. Bull.*, 1908.

THE EXISTENCE OF HOMOGENEOUS GROUPS OF LARGE IONS

BY OSWALD BLACKWOOD

RYERSON LABORATORY, UNIVERSITY OF CHICAGO

Communicated by R. A. Millikan, March 12, 1920

The Zeleny mobility apparatus has been modified by the author so as to be capable of giving a decisive answer to the question as to whether the large ions produced by spraying distilled water are of many different sizes or whether—as claimed by certain observers[1]—only a few different sizes are present in the ionization. In other words, is there a *continuous* spectrum of mobilities or a *line* spectrum? The investigation is fully described in an article which is about to appear in the *Physical Review*.

The mobility apparatus consists of a brass cylinder 160 cm. long and

5 cm. internal diameter, which is fitted with two co-axial electrodes 2 cm. in diameter and, respectively, 105 and 35 cm. long. (See fig. I.) The electrode L' is grounded, while L'' is connected to a pair of quadrants of an electrometer. Any desired potential may be established between the cylinder and the electrodes by means of a battery of dry cells.

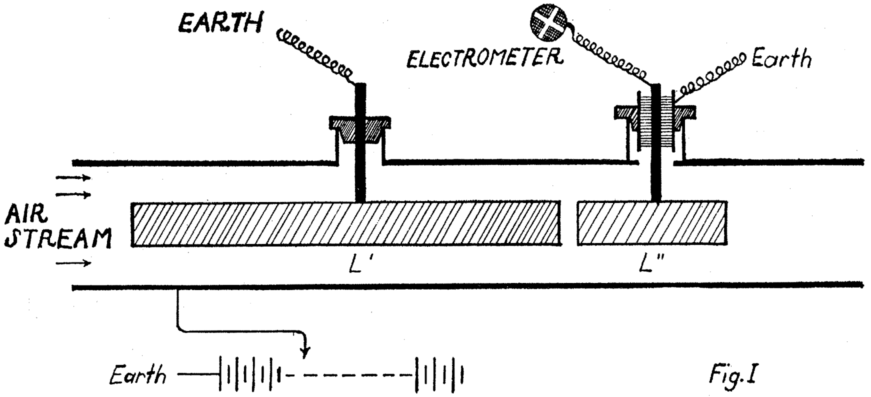

Fig. I

The ions to be tested are carried by a blast of air through the cylinder in a direction parallel to its axis. If there is no electric field, none of the ions are driven to the electrodes and the electrometer current is zero. When, however, a field is established and is increased progressively, more and more ions are driven from the air stream; the current increases and achieves its maximum value at a critical voltage V' at which all the ions are caught. As the field is still further augmented, the long, grounded electrode catches more ions, fewer reach the second electrode, and finally —at a voltage V''—the current again becomes zero. The voltages V' and V'', corresponding to the maximum and zero currents, respectively, may be computed for ions of mobility k by means of the formula:

$$k = \frac{Q}{2\pi L'V''} \log_e b/a = \frac{Q}{2\pi(L' + L'')V'} \log_e b/a$$

a and b being the radii of the outer and inner cylinders, Q the volume of air traversing the tube each second, L' and L'' the lengths of the long and short electrodes.

Figure I shows the forms and relative positions of the three theoretical current-voltage curves for ions of respective mobilities, 0.0043, 0.0010, and 0.0004 cm. per second in a field of one volt per cm. These are the values found for successive groups of ions by the observers mentioned above.[1] The dotted line indicates the summation curve produced when the three classes of ions are simultaneously present in equal concentration. It will be noted that this curve has three well-defined *peaks*, each corresponding to a certain class of ions.

The experimental curves which have been determined by the author for ionization from spray, and also for that from hot wires, are all of the type shown in fig. III. The fact that no curve has a plurality of peaks proves that—contrary to the findings of other workers[1]—a series of widely separated, well-defined mobility groups does not exist.

Decrease of Mobility with Time.—It has been found that if the ions are tested soon after their production the mean mobility is relatively high. If, however, metal tubes are interposed between the sprayer and the testing tube, so as to increase the period between the production of the ions and their testing, the mean mobility decreases and higher voltages are necessary to produce maximum ion currents. (Fig. III, (*A*) and (*B*).) The author, using a red hot platinum wire as a source of ionization, finds that the rate of decrease of mobility can be retarded by drying the air in which the ions are produced. (Compare curves (*B*) and (*C*), fig. III.) This indicates that the decrease of mobility is due, in part at least, to the growth of the ions by condensation of water vapor.

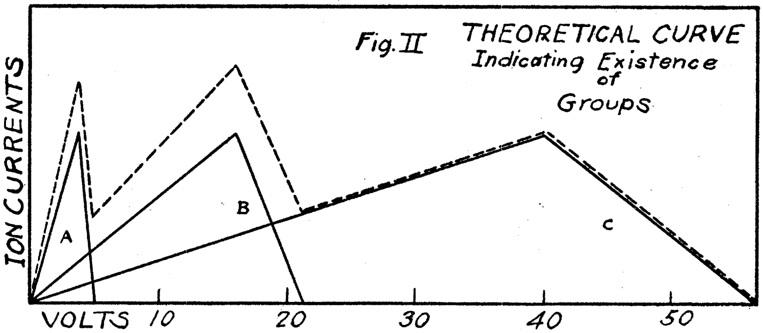
Fig. II THEORETICAL CURVE Indicating Existence of Groups

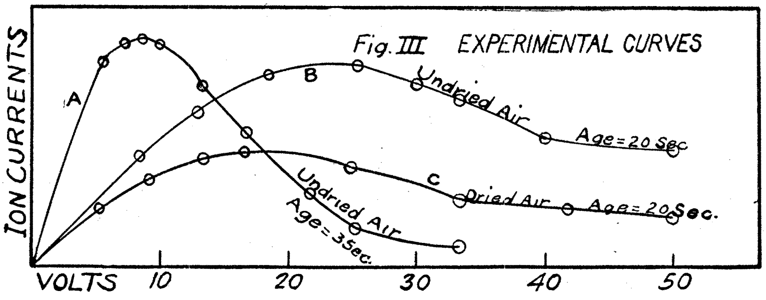
Fig. III EXPERIMENTAL CURVES

Nature of the Large Ion.—It has now been shown that—contrary to the findings of other observers[1]—a series of widely separated, well-defined mobility groups does not exist in the ionization from spray. Their hypothesis that the large ion is a complex cluster of stable water globules may consequently be abandoned in favor of the simpler conception of J. J. Thomson and others who have pictured the large ion as merely a charged globule of water having a radius of equilibrium which is a function of the humidity of the air.

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[1] McClelland, J. A. and Nolan, P. J., *Proc. Roy. Irish Acad.*, A **33,** 1916 (29); Nolan, P. J., *Ibid.*, A **33,** 1916 (10); McClelland, J. A. and Nolan, P. J., *Ibid.*, A **35,** 1919 (1).

THE RELATION BETWEEN THE ISOELECTRIC POINT OF A GLOBULIN AND ITS SOLUBILITY AND ACID COMBINING CAPACITY IN SALT SOLUTION

By Edwin J. Cohn

Harriman Research Laboratory, Roosevelt Hospital, New York

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Globulins are, by definition, soluble in solutions of the salts of strong acids and strong bases[1] and tuberin, the protein of the potato, has accordingly been classified as a globulin.[2] In the juice that can be squeezed from the potato, tuberin is dissolved on account of the high concentration of electrolytes.[3] It is precipitated by dialysis of the juice, and readily redissolves in solutions of neutral salts. The effect of neutral salts in dissolving tuberin is, however, variable with the hydrogen ion concentration. The nature of this variation, and to some extent its causes and its meaning for the classification of proteins, is considered in this paper.

The tuberin that was employed in these experiments was precipitated by dialyzing potato juice that had been freed from starch by filtration through pulp, in a collodion bag against tap water. After a period of days the tuberin had largely precipitated and settled. The contents of the collodion bag were then evenly suspended, transferred in 100 cc. samples to flasks, and brought to different hydrogen ion concentrations by the addition of the amounts of sodium hydroxide and hydrochloric acid recorded in table I. The systems containing tuberin and acid, or tuberin and base in identical concentration were next divided, and added to vessels containing different amounts of sodium chloride. The systems, therefore, varied in two respects; in the first place in the amount of free, and, therefore, of combined protein, acid or base; in the second place in the amount of salt that they contained. After they had stood at constant temperature for about 6 hours, and it was believed that equilibrium had been established, the hydrogen ion concentrations of the systems were electrometrically determined, and the solubility of the tuberin in them was estimated by determining nitrogen in an aliquot part after the precipitated tuberin had been removed by centrifuging. In certain of the systems it will be noted that all of the protein dissolved. In these cases, therefore, the data do not represent solubility; that is solutions saturated with respect to protein.

The results obtained in this preliminary investigation were not, it is true, altogether regular. Abnormal values of nitrogen and also of hydro-